PROECCO Program

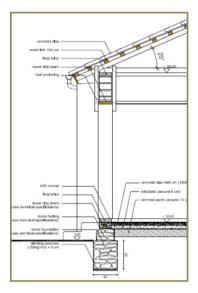
Implementing a building with adobe: Logbook



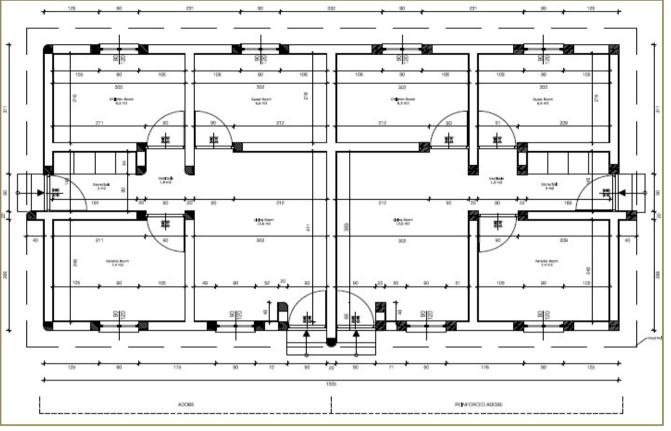




Ongoing Process : **Technical Drawings**

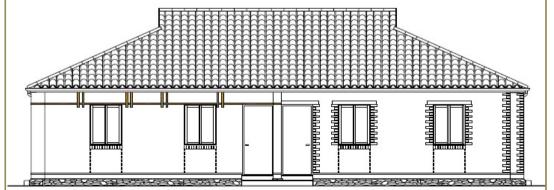


This pilot building has been conceived to propose several constructive options. The left half side (A) and the left one (B) have different technical solutions.



Side A Adobe

Side B Reinforced Adobe













Ongoing Process : **Site Selection**

The site was chosen in close cooperation with the authorities involved in the program.











Ongoing Process: Terracing

The steeply sloping of the site has imposed an important work of preliminary terracing.

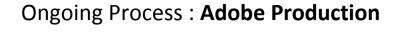












After testing several soil-sand-fiber ratios, the fitting mixture was found.















Ongoing Process : Setting up



The position of the building is the result of compromise between the needs of future users and the several constraints of the site







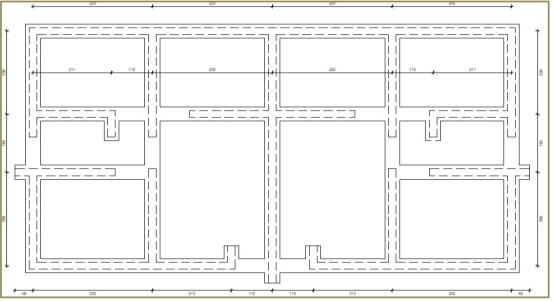






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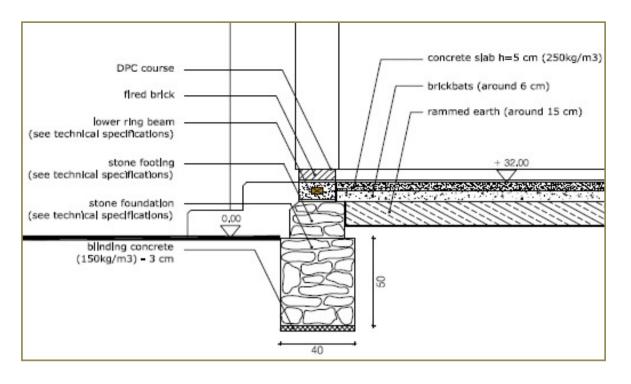
Ongoing Process : **Digging Trenches**



The foundations trenches (see plan above) were 50 cm deep and 40 cm wide.









Ongoing Process : **Stone Foundation**



After laying 3 cm of lean concrete on the bottom of the trench (150kg/m³), stones are put in place with cement mortar.











Ongoing Process : **Stone footings**



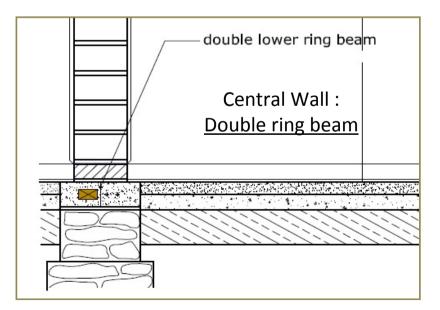
In order to protect the base of the walls from friction and water erosion, a 30 cm high stonecement base has been foreseen.

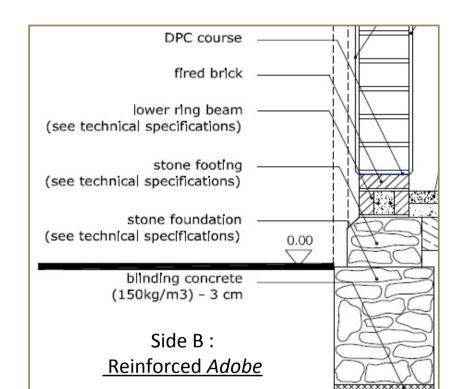
Great attention has been paid to prevent corners damages, to drain rain water away and to make a smooth and good looking external surface.





fired brick lower ring beam (see technical specifications) stone footing (see technical specifications) stone foundation (see technical specifications) blinding concrete (150kg/m3) - 3 cm Side A : Adobe





Ongoing Process: Lower Ring Beam

For the lower ring beam two different solutions have been proposed:

- Side A: between two lines of fired bricks as formwork, wood lintels drown in a lime-sand mortar (350kg/m³)
- Side B: between two lines of fired bricks as formwork, reinforced concrete beam (300kg/m³)











Ongoing Process: Lower Ring Beam

Side A: wood lintels drown in a lime-sand mortar (350kg/m³)













Ongoing Process: Lower Ring Beam

Side B: reinforced concrete (300kg/m³)











Ongoing Process: Lower Ring Beam

Central Lower Ring Beam: to preserve the effectiveness of both of ring beams, mostly in case of earthquake, the two constructive elements have been kept separated.









Ongoing Process : **Doorsteps**

To avoid bricks erosion over time, doorsteps are made out of concrete. This solution allow to keep continuity of the lower ring beam.













Ongoing Process : **DPC** (Damp Proof Course)

To avoid water to rise into the wall by capillarity, a water proof barrier has been laid just before the first adobe course.

Materials standing under the DPC must be water resistant.









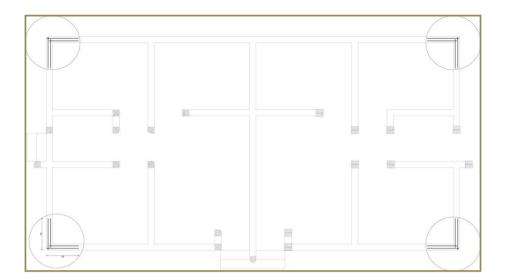
Adobe blocks are laid with soil mortar; for fired bricks, mortar is a sand-cement-lime mixture.







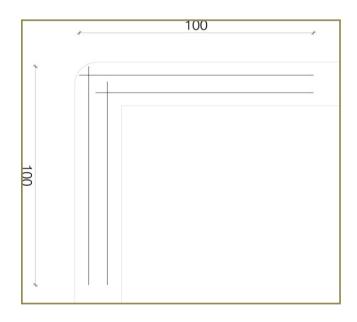




Ongoing Process : Masonry – Corner Reinforcements

To improve earthquake resistance, reinforcements have been foreseen in the four angles of the building every four brick courses.











Ongoing Process : Masonry – Corner Reinforcements

To improve corner resistance, rounded stabilized Adobe (side A) and fired bricks (side B) have been laid.











Ongoing Process: Masonry – Doors and windows anchoring





Some examples of doors anchoring









Ongoing Process : Masonry – Details

•Window sills have been made out of fired bricks laid with lime-cement-sand mortar.



•The top of the walls is protected from seepages by a course of fired bricks and lime-cement-sand mortar.







 Ventilations have been implemented on the top of the windows. Wiring has been implemented after masonry works. Lines will be covered by the plaster.

Ongoing Process : Wiring



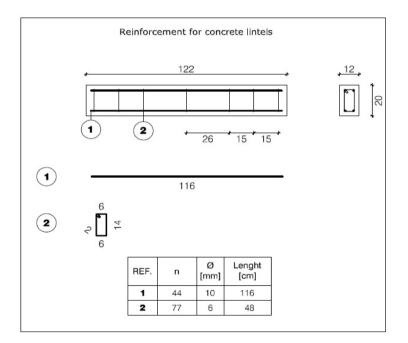












Concrete lintels have been prefabricated about five weeks before to be laid on.

Ongoing Process : **Precast Concrete Lintels**



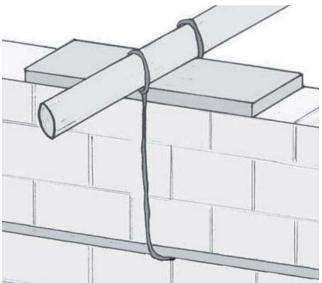












The bearing structure is tied by means of two ∅6mm iron bars for each anchor point. These steel bars stay under the upper ring beam to guarantee a strong link.

Ongoing Process: Roof Anchoring











Ongoing Process: **Upper Ring Beam**

The **upper rings have** been laid at a different height. Since sides A and B differ, they behave differently in case of earthquake. Therefore they must be as disconnected as possible from one to another.

Side A: wood ring beam.

Side B: concrete ring beam between two fired bricks as formwork.











Ongoing Process : **Trusses**

The load bearing structure is composed by five trusses and 6 half trusses making a four slopes roof. To get the openings on the top of the roof, the trusses are 30° sloped instead of the half trusses that are 25° sloped.



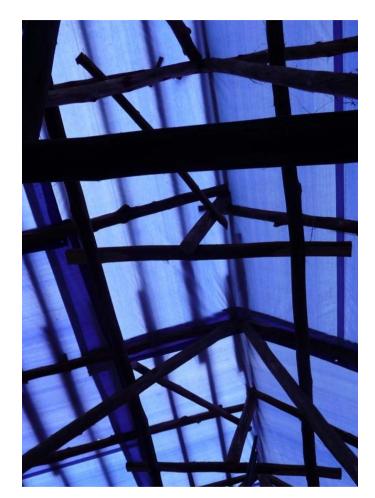








Ongoing Process: Load Bearing Structure



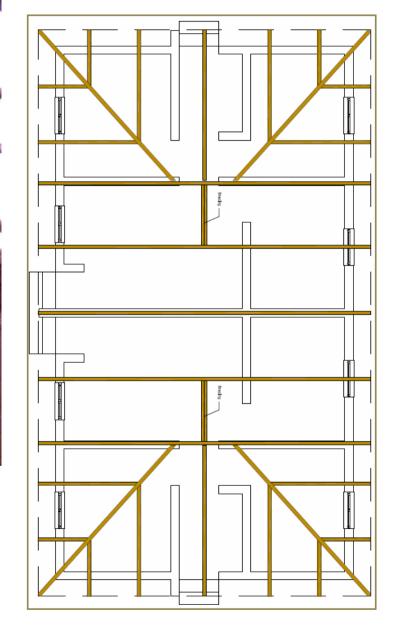


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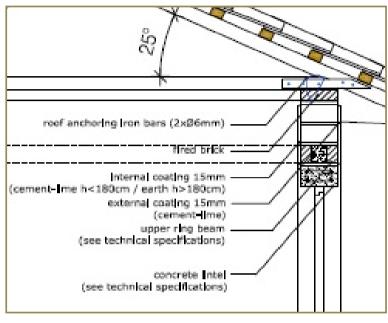






Ongoing Process: Purlins





Some images and details about roof implementation.











Ongoing Process: **Doors and Windows**

Doors and windows have been produced by a workshop nearby the site.









Ongoing Process: External Plastering

External plaster is a sand-cement-lime mixture at the ratio in volume of 8-1-2. Fired blocks and wood ring beam are not plastered.

It has been implemented in two coats. A first raft layer to level wall surfaces and a second finishing layer.









Ongoing Process: Internal Plastering

Internal plaster is a sand-cement-lime mixture up to 180 cm and a mud plaster from 180 cm up to the top of the wall. Fired blocks and wood ring beam are not plastered.







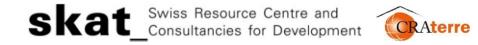
Cost of material and labour in Nyarushishi in 2014 2015.





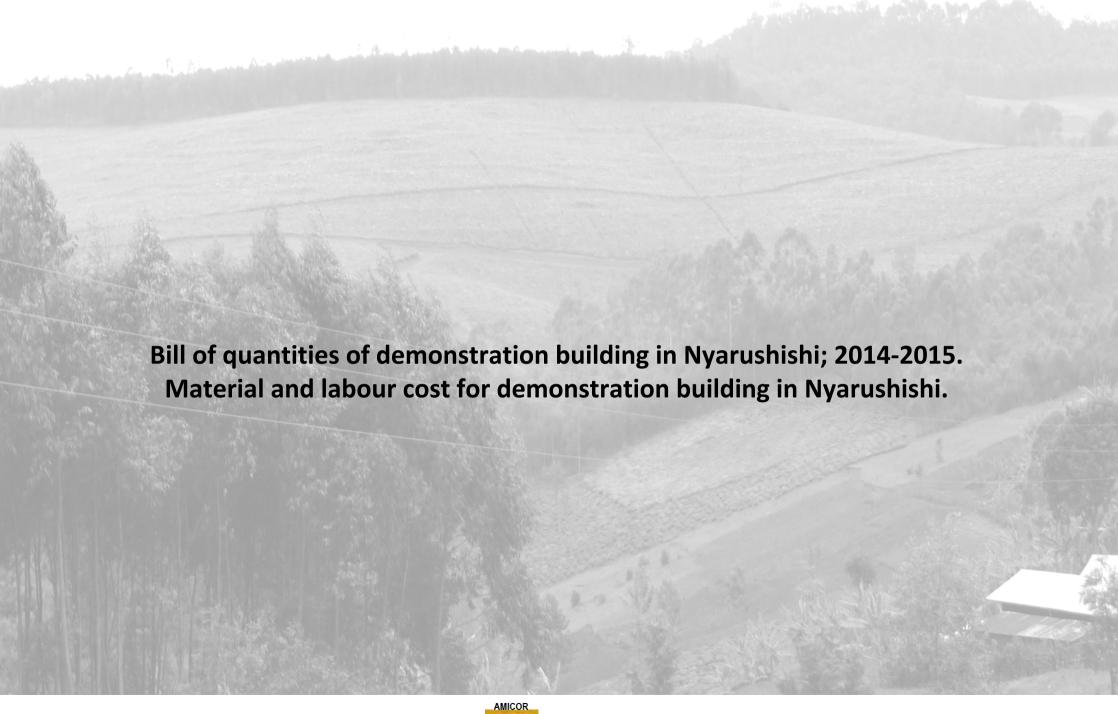
Cost of material and labour in Nyarushishi in 2014 2015.

Designation	Unit	Unit cost including transport to the site
alponi		
Unskilled labour	Day	1.500,00 RWF
Masson	Day	3.000,00 RWF
Carpenters	Aeo	4.500,00 RWF
TO CHAIN	A-	a. sadd, and Kant
Minerals		
Stone Mwezi	m3	13.750,00 RWF
Grawel	mg ·	21.250,00 RWF
SCEB soft Kyaso	m3	23.750,00 RWF
The second section of the section of the second section of the section of the second section of the section of the second section of the section of th		
Proceedings in a comment	400	3000 00 0008
Clay roofine tiles		130.00 RWF
Fired bridge	Unit	40,00 RWF
Stabilized adobe 20x20x10	Unit	75,00 RWF
SCEB 100x140x295 Adobe 20x20x10	The Court	355,00 RWF 50.00 RWF
Binder	2 2 3 3 3	
Ume	40 kg	3.400,00 RWF
Water	ŭ E	2 500 00 RWF
Z = 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2 - 2		
Metal		as a region benefit formed to
Metal strip	1,2 m	TUNIO CONT.
Steel bar 6 mm	12 m	2.500,00 RWF
Steel bar 12 mm	12 m	5.490,00 RWF
Wire I mm	999	1.400,00 RWF
Wood		
Planck 170*50*360	net	2.600,00 RWF
Planck 170*20*360	#55 #55 #55 #55 #55 #55 #55 #55 #55 #55	1.500,00 RWF
local mat for celling (1,2%) mil	Holl	1 400 00 BWF
Local poles (wood)	4m	1.400,00 RWF
Carpentry		
Dutside door (0,9 * 2,1 m) Including all handware inside door (0.9 * 2,1 m) Including all handware.	ties.	51.000,00 RWF
Mindows (1.17*0.95 m)	E CO	41 000 00 RWF
Windows (1,20*0,90 m)	Unit	41.000,00 RWF
Others		
Dead oil	20/	6.000,00 RWF
Oil paint	4 litre	9.500,00 RWF
Water paint	20 libre	17.500,00 RWF 6.500,00 RWF
Part also for toilet	See of Maria	TO DOD OD BANE
Gutter (metal) 1,5 mm	2ml	8.000,00 RWF
Hardware for gutter	Lump sum per linear meter	1.000,00 RWF
Water tank 2 000 liter Glass	Unit 1*1,2 m	290.000,00 RWF 10.000,00 RWF
Electricity Wire 1.5mm	rolls 100m 1x2 5mm	9 500 00 W
PVC ploe 5/8	Ém	400.00 RWF
Switch	Unit	750,00 RWF
Sockers	Unit	550,00 RWF
Lamp	Christ	750,00 RWF











Basic Adobe

Items	Unit	Unit Cost in RWF	Unit cost in US\$	Quantities	Cost in RWF	Cost in US\$
Site preparation	m²	30,00	0,04	167,58	5.027,40	7,34
Site Excavation	m3	1.050,00	1,53	498,60	523.530,00	764,28
Foundation excavation	ml	315,00	0,46	43,50	13.702,50	20,00
Stone foundation	ml	8.897,00	12,99	43,50	387.019,50	564,99
Stone massonry for bassement	ml	5.356,05	7,82	43,50	232.988,18	340,13
Adobe walls	m²	2.308,50	3,37	113,10	261.091,35	381,16
Massonry reinforcement at the angle (Stabilized adobe)	m²	13.439,90	19,62	1,30	17.471,87	25,51
Fired bricks massonry (horizontal layer at the base and at the top of the walls)	ml	1.210,90	1,77	43,50	52.674,15	76,90
Roof (woodwork, waterproofing and clay tiles, includind hardware)	Living space (m2)	10.771,50	15,72	48,18	518.970,87	757,62
Wood lintel on top of windows	ml	940,00	1,37	11,00	10.340,00	15,09
Windows	Unit	36.609,43	53,44	4,00	146.437,72	213,78
Internal doors	Unit	51.742,60	75,54	4,00	206.970,40	302,15
External doors	Unit	76.242,60	111,30	2,00	152.485,20	222,61
Wooden ringbeam	ml	567,00	0,83	43,50	24.664,50	36,01
Concrete slab	m²	6.221,67	9,08	40,80	253.844,00	370,58
Internal plaster	m²	1.360,90	1,99	176,44	240.117,20	350,54
External plaster	m²	2.086,35	3,05	83,28	173.751,23	253,65
Ceiling with local mats	m²	2.537,25	3,70	40,80	103.519,80	151,12
Plinth	ml	336,15	0,49	57,20	19.227,78	28,07
Well	m3	3.930,00	5,74	7,85	30.866,22	45,06
Sink	m3	18.130,00	26,47	7,85	142.393,02	207,87
Lumpsum for electricity	Lumpsum	143.650,00	209,71	1,00	143.650,00	209,71
Watter tank and all hardware	lumpsum	294.500,00	429,93	1,00	294.500,00	429,93
Gutters	ml	6.870,00	10,03	15,20	104.424,00	152,44
Pavement	ml	3.398,33	4,96	27,80	94.473,67	137,92
		TOTAL cost (labe	our and material)		4.154.140,55 RWF	6.064,44 USD
			Living space		40,80	40,80
		Cost per r	m2 of living space		101.817,17 RWF	148,64 USD

Nota 1: Cost is subject to change according to site specificity and inflation. Nota 2: Cost do not include taxes, margin of contractors, etc...







Reinforced Adobe

Items	Unit	Unit Cost in RWF	Unit cost in US\$	Quantities	Cost in RWF	Cost in US\$
Site preparation	m²	30,00	0,04	167,58	5.027,40	7,34
Site Excavation	m3	1.050,00	1,53	498,60	523.530,00	764,28
Foundation excavation	ml	315,00	0,46	43,50	13.702,50	20,00
Stone foundation	ml	8.897,00	12,99	43,50	387.019,50	564,99
Stone massonry for bassement	ml	5.356,05	7,82	43,50	232.988,18	340,13
Adobe walls	m²	2.308,50	3,37	113,10	261.091,35	381,16
Massonry reinforcement at the angle (Stabilized adobe)	m²	13.439,90	19,62	0,85	11.423,92	16,68
Fired bricks massonry (horizontal layer at the base and at the top of the walls)	ml	1.210,90	1,77	43,50	52.674,15	76,90
Roof (woodwork, waterproofing and clay tiles, includind hardware)	Living space (m2)	10.771,50	15,72	48,18	518.970,87	757,62
Wood lintel on top of windows	ml	2.909,44	4,25	11,00	32.003,84	46,72
Windows with Fired bricks reinforcement	unité	38.648,70	56,42	4,00	154.594,80	225,69
Internal doors	unité	51.742,60	75,54	4,00	206.970,40	302,15
External doors	unité	82.986,20	121,15	2,00	165.972,40	242,30
Reinforced concrete ringbeam	ml	4.022,67	5,87	43,50	174.986,15	255,45
Concrete slab	m²	6.221,67	9,08	40,80	253.844,00	370,58
Internal plaster	m²	1.360,90	1,99	176,44	240.117,20	350,54
External plaster	m²	2.086,35	3,05	83,28	173.751,23	253,65
Ceiling with local mats	m²	2.537,25	3,70	40,80	103.519,80	151,12
Plinth	ml	336,15	0,49	57,20	19.227,78	28,07
well	m3	3.930,00	5,74	7,85	30.866,22	45,06
Sink	m3	18.130,00	26,47	7,85	142.393,02	207,87
Lumpsum for electricity	Forfait	143.650,00	209,71	1,00	143.650,00	209,71
Watter tank and all hardware	Forfait	294.500,00	429,93	1,00	294.500,00	429,93
Gutters	ml	6.870,00	10,03	15,20	104.424,00	152,44
Pavement	ml	3.398,33	4,96	27,80	94.473,67	137,92
	Т	OTAL cost (labour			4.341.722,36 RWF	
		Cost per m2 o	Living space of living space		40,80 106.414,76 RWF	40,80 155,35 USD

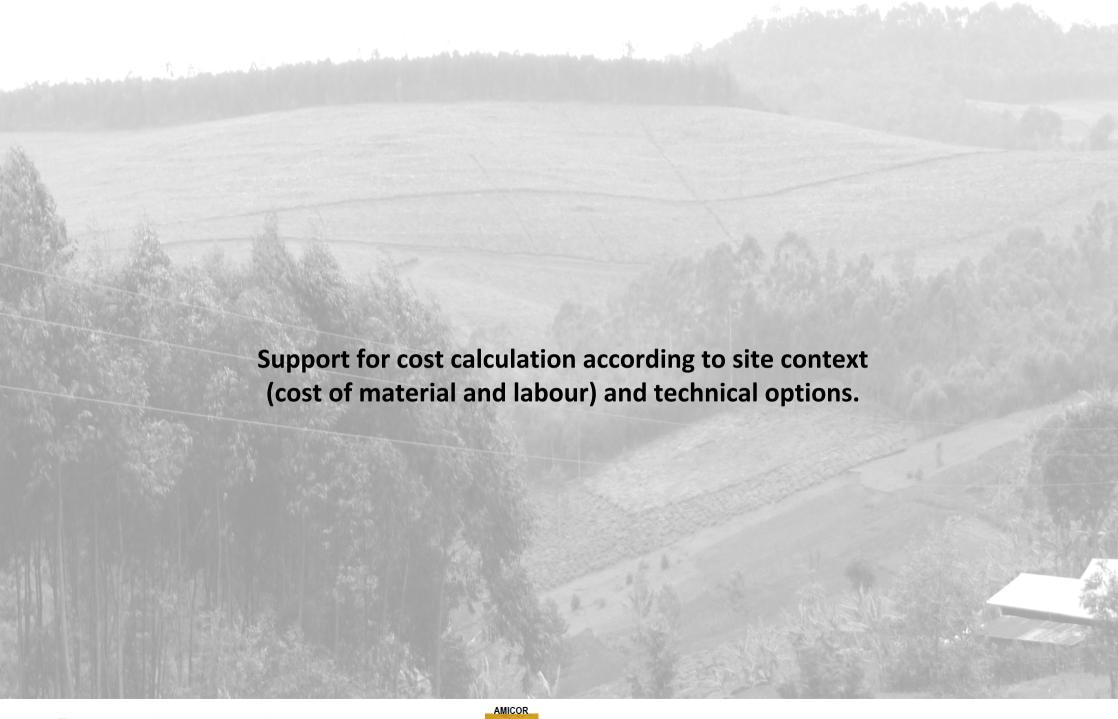
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Nota 2: Cost do not include taxes, margin of contractors, etc...



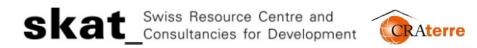








Désignation		2131123	Coût unitaire	Consequence	-2020	120200000
	Unité	Coût unitaire Frw	US\$	Quantities	Coût Frw	Coût US\$
Site preparation	m²			167,58		
Excavation	m3			according to site context (slope)		
Foundation excavation	ml		-	43,50		-
Options: Choose one of the following alternative						
Fired bricks foundation with cement/lime mortar	ml		-	43,50	-	
Stone foundation with cement/lime mortar	ml		-	43,50	-	-
Stone foundation with earth mortar and cement/lime pointing	ml			43,50	-	-
Options: Choose one of the following alternative	The state of the s					
Fired bricks foundation with cement/lime mortar	ml		-	43,50		-
Stone foundation with cement/lime mortar	ml		-	43,50	-	2
Fired brick foundation with earth mortar and cement/lime pointing	ml		-	43,50	-	
Stone foundation with earth mortar and cement/lime pointing	ml		-	43,50	-	-
Adobe walls	m2			113,10		
Options: Choose one of the following alternative	m ²		-	102	-	-
Corner reinforcment with Fired brick	m ²		-	1,30		-
Corner reinforcement with stabilised adobe	m ²		-	1,30	-	-
Horizontal Fired Brick massonry layer	ml		-	43,50	-	-
Options: Choose one of the following alternative						
Fired clay tile roof	m2 living space		-	48,18	-	-
Options: Choose one of the following alternative						
Lintel with wooden planck 5*7	ml		-	11,00	-	-
Lintel with wooden planck 2,5*7 plus fired brick arche	ml		-	11,00	-	-
Lintel with wooden planck 2,5*7 plus adobe arche	ml		-	11,00		-
RCC precast lintel	ml		-	11,00		-
Options: Choose one of the following alternative						
Windows	unité		-	4,00		-
Windows plus wall reinforcement with fired clay bricks	unité		-	4,00		-
Internal door	unité		-	4,00		-
Options: Choose one of the following alternative						
External door	unité		-	2,00		-
External door plus wall reinforcement with fired clay bricks	unité		-	2,00	-	-
Options: Choose one of the following alternative						
Wooden ring beam with planck 5*7	ml		-	43,50	-	
RCC ring beam	ml			43,50	-	
Concrete slab	m²			40,80		
Internal plaster	m²			176,44	-	
External plaster	m ²			83,28		







Options: Choose one of the following alternative					
Ceiling out of playwood	m ²	-	40,80	-	-
Ceiling out of local mats	m ²		40,80	-	-
Plinth	ml	-	57,20		
Well	m3	-	7,85		
Sink	m3	(n)	7,85		
Electricity	Forfait	-	1,00		•
Water storage	Forfait	+0	1,00	•	-
Gutters	ml	-7	15,20	-	-
Pavement	ml	Ψ,	27,80	-	
Other	•	-			
Other	•	-			
Other					
Other	•				
		TOTAL cost (labour and material)		-	
		Living space		40,80	40,80
		Cost per m2 of living space		-	-



